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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/509,472	04/21/2000	MASARU MITSUI	105875	9665

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EXAMINER
THORNTON, YVETTE C

ART UNIT	PAPER NUMBER
1752	

DATE MAILED: 03/17/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/509,472	MITSUI ET AL.	
	Examiner	Art Unit	
	Yvette C. Thornton	1752	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

P riod for R ply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *31-66* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *31-34,41,42,47-57,60 and 63-66* is/are rejected.

7)☒ Claim(s) *35-40,43-46,58,59,61 and 62* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 May 2000* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *15* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

This is written in reference to application number 09/509472 filed on May 19, 2000 and is a 371 of PCT/JP99/04124 filed on July 30, 1999.

Request for Continued Examination (RCE)

1. The request filed on October 3, 2002 for a Request for Continued Examination (RCE) under 37 CFR 1.53(d) based on parent Application No. 09/509,472 is acceptable and a RCE has been established. An action on the RCE follows.

Information Disclosure Statement

2. The Information Disclosure Statements filed on August 21, 2000 and August 23, 2002 have been entered and fully considered.

Response to Amendment

3. Claims 1-30 have been cancelled. Newly submitted claims 31-66 are currently pending.

4. The examiner notes that the specification mainly pertains to the use of a chromium thin film. However page 41, lines 9-16 of the specification indicates that the film can be composed of a material containing mainly a transition metal such as titanium, nickel, copper, molybdenum, tantalum or tungsten.

Claim Objections

5. Claims 31, 33, 35, 37, 39, 41, 43-44, 46-49 and 66 are objected to because of the following informalities: the last 5 lines of claim 31 as written, are unclear. The examiner suggests re-wording the said lines to read as follows: "wherein the content of He in the thin film is in a range of a film stress that the amount of change in flatness is equal to -2μm or

less." The examiner notes that the change of flatness is clearly discussed in the specification on page 5, lines 9-21. Appropriate correction is requested.

6. The examiner has interpreted the minus sign in instant claim 31 to be an indication of tensile stress as opposed to a plus sign, which indicates a change in compressive stress (spec. pg. 5, l. 9-21).

7. The examiner notes that claims 32, 34, 36, 38, 40, 42, 45, 50, 52-44 and 57-65 refer to a vacuum chamber. It is the examiner's position that a sputtering apparatus inherently has a vacuum chamber. This position is supported by disclosure of Torus Sputter Sources by the Kurt J. Lesker Company (http://www.lesker.com/cfdocs/newweb/framesets/frameset_downloads.cfm), which discloses that sputtering is a deposition technique in which material is removed from a solid target by ion bombardment, and then deposited in atomic layers on a substrate. The source of ions is a low-pressure plasma created by electron bombardment of an inert gas contained in a vacuum chamber at 1 to 30 millitorr (pg. 2 lines 1-8). The following rejections are based on such an interpretation.

Drawings

8. Figure 11 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). The examiner notes that figure 11 is discussed in the background of the invention (pg. 5, l. 5-21), and therefore not considered to inventive. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

10. Claims 31, 47, 49-50 and 60 are rejected under 35 U.S.C. 102(a) as being anticipated by Shinji et al. (JP 11-012730, machine translation) with Yang et al. (US 6358636 B1) cited to show inherent properties. Shinji teaches a process of forming an integrated circuit pattern of a thin chromium (Cr) film of low stress on a conductive substrate by using a He-Ar gaseous mixture of a specific composition as a sputter gas in a sputtering method using Cr as a sputtering target. The said gas mixture contains 5 to 25 vol% Ar gas and the balance He gas (i.e., 75-95 %) (abstract). When the amount of Ar is less than 5%, plasma is not stabilized and sputtering becomes difficult. When the amount of Ar exceeds 25%, the amount of supply of He incorporated is decreased and the stress controlling property becomes deteriorated (abstract). The examiner is of the position that this statement suggests that the correlation between the He contained in the atmosphere gas and the film stress is determined prior to introducing the gas into the vacuum chamber of the sputtering apparatus. Thereby meeting the limitations of instant claim 50.

The taught invention gives a Cr thin film, which has low stress with sufficient adhesion with a ground (i.e., substrate) (p. 0010). Suitable substrates include a silicon wafer, glass and synthetic resin. Shinji exemplifies a process wherein a Cr film is sputtered onto a silicon substrate. Sputtering was performed at a spatter power of 800 W. The helium gas

was introduced into 50 sccm and the argon was introduced at a flow rate of 5 sccm (10:1). A Cr film of 50 nm was formed. The said film changed from compressive stress to tensile stress by 4-6 mTorr, and it became about 0 stress by 5 mTorr (p. 0017-0020). While Shinji fails to exemplify the use of a transparent substrate. One of ordinary skill in the art could clearly envision, from the teachings of Shinji, the use of a glass substrate, which is naturally transparent. It is the examiner's position that a Cr thin film would inherently posses a shading function as claimed by the instant application. The examiner is also of the position that a system having a Cr thin film sputtered onto a transparent substrate in an atmosphere containing He in the amount of 75-95 vol% would inherently have a change in flatness (tensile stress) of less than -2μm.

Shinji teaches that the sputtering system used is a RF sputtering system made from ANELVA, SPF-530H (p. 0018). Yang teaches that conventional sputtering systems such as ANELVA (Japan) are double sided, in-line high-throughput machines having two interlocking systems for loading and unloading (c. 4, l. 20-30).

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

12. Claims 32, 51-54 and 63-64 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shinji (JP 11-012730, machine translation) with Yang (US 6358636 B1)

as applied to claims 31, 47, 49-50 and 60 above and in further view of Inoue et al. (US 6309515 B1). Shinji as discussed above teaches a process of forming a thin Cr film on a glass substrate. Shinji exemplifies a process wherein chromium is sputtering at a spatter power of 800 W. It would have been obvious to one of ordinary skill in the art to increase the sputtering power in order to increase the film yield, as it is well known and conventional in the art. This position is supported by teachings of Inoue et al. (US 6309515 B1), which shows in figure 20 that an increase in power causes an increase in yield percentage.

Shinji is silent on the deposition rate used to deposit the metal on the taught substrate. However, since there is a direct relationship between sputtering power, deposition rate and film yield (see figure 21 of Inoue), one of ordinary skill in the art would expect that an optimization of one parameter (i.e., film yield) would result in the optimization of another (sputtering power, deposition rate).

13. Claims 34, 42 and 55-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shinji (JP 11-012730, machine translation) with Yang (US 6358636 B1) in view of Inoue et al. (US 6309515 B1) as applied to claims 31-32, 47, 49-54, 60 and 63-64 above and in further view of Mitsui et al. (US 6087047 A). Shinji in view of Inoue teach all the limitations of the instant claims except it fails to teach the presence one or both of carbon or oxygen. Mitsui teaches that it is effective to introduce oxygen in the semi-transparent film in order to obtain the desired semi-transparent film by controlling the optical absorption characteristic and the optical transmission characteristic in balance (c. 8, l. 56-62). One of ordinary skill in the art would have been motivated by the teachings of Mitsui to incorporate

oxygen into the thin film of Shinji in order to control the optical absorption and optical transmission in balance.

Mitsui further teaches that nitrogen in the film controls the transmittance and is effective to mainly change the refractive index (c. 8, l. 54-55). One of ordinary skill in the art would have been motivated by the teachings of Mitsui to incorporate nitrogen into the thin film of Shinji in order to control the transmittance and refractive index.

14. Claims 31, 33, 41, 48-50 and 65-66 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mitsui et al. (US 6087047 A). Mitsui teaches a half-tone phase shift mask blank in which a semi-transparent film is formed on a transparent substrate. It is the examiner's position that a semi-transparent film meets the limitation of a film having a shading function as set forth in the instant claims. The semi-transparent film includes silicon and nickel and at least one selected from the group consisting of nitrogen, oxygen and hydrogen (abstract). Nitrogen in the film controls the transmittance and is effective to mainly change the refractive index (c. 8, l. 54-55). The oxygen is effective for controlling the transmittance. In particular, it is effective to introduce the oxygen in the semi-transparent film in order to obtain the desired semi-transparent film by controlling the optical absorption characteristic and the optical transmission characteristic in balance (c. 8, l. 56-62). The nitrogen is added in order to avoid reduction of the refractive index due to the excess oxygen, which serves to improve the refractive index (c. 9, l. 10-13). Mitsui teaches that nickel in the film is effective to satisfy the basic requirement characteristics such as transmittance and the reflective index for the exposure wavelength by selecting and controlling film composition containing nickel and the film quality. Further, nickel in the film effectively improves the

electrical characteristics, the optical characteristics and the chemical durability in the film itself or with the other metal or transition metal elements (c. 9, l. 23-c. 10, l. 7). Stress generated in the film can be controlled to the desired value by the use of the amorphous film structure (c. 10, l. 12-13). The depositing method of the semi-transparent film includes a variety of thin film forming methods such as sputtering deposition method, the vaporizing method, the chemical vapor deposition method, the ion beam deposition method and the electron beam vaporizing method. Among them, the sputtering deposition method, which uses as sputtering target and gas containing constituent element of the semi-transparent film, is most effective in regard to productivity, manufacturing yield and the stability of the mask material (c. 10, l. 47-57). It is possible to readily entrap the nitrogen, the oxygen and the hydrogen by using these gases themselves or mixing them and by mixing them with gases such as helium (He), argon (Ar) and xenon (Xe) (c. 11, l. 37-42). The phase shift mask can be obtained by using the above-mentioned phase shift mask blank and by forming the semi-transparent mask to be transferred into the wafer on the transparent substrate. In this event, the semi-transparent film on the blank is patterned by the use of the lithography method. As such lithography method, a method, which is used in the general mask manufacturing process, may be applied such as dry etching (c. 11, l. 51-64). A dry etch process would selectively remove the film formed on the taught substrate. Mitsui teaches that the taught invention relates to a phase shift mask for use in exposing and transferring a fine pattern (c. 1, l. 5-9).

Mitsui exemplifies a third example wherein the sputter target was fabricated by mixing the silicon and nickel at the rate of about 3:1 by mol. The semi-transparent film was formed

on a quartz substrate by the direct current sputter using a sputter gas mix of Ar, N_2, O_2 and H_2 at the rate of 20:74:1:5 by the flowing rate (c. 14, l. 48-c. 15, l. 60). Mitsui further exemplifies a sixth example wherein the sputter target was fabricated by mixing the silicon, the oxidation silicon, the nickel and tantalum with the rate of about 5:2:2:1 by mol. The semi-transparent film was formed on a quartz substrate by the direct current sputter using a sputter gas mix of Ar and N_2 at the rate of 4:6 by the flowing rate (c. 18, l. 22-c. 19, l. 27). The seventh example further teaches a sputter target fabricated by mixing silicon, the oxidation silicon, the nickel and tantalum with the rate of about 5:2:2:1 by mol and using a sputter gas mixture of Ar, N_2, and H_2 at the rate of 3:6:1 by the flowing rate (c. 19, l. 30-c. 20, l. 35). It is the examiner's position that nickel and tantalum both meet the limitations of a transition metal as set forth in the instant claims. The said examples were irradiated with ArF excimer laser having an oscillation wavelength of 193 and energy density of 1 mJ/cm^2 per unit pulse with 10^7 pulses. The formed fabricated film was etching by the use reactive ion etching (RIE).

Mitsui fails to exemplify a process wherein He gas is used. However, Mitsui does teach that Xe gas or He gas may be used instead of Ar. (c. 21, l. 6-11). One of ordinary skill in the art would have been motivated by the teachings of Mitsui to make thin film by the exemplified processes, particularly examples 3, 6 and 7, wherein the sputter gas contains He in the content of 20%, 40% and 30 % respectively. One of ordinary skill would have been motivated by the teachings of Mitsui to substitute the exemplified argon gas for helium gas and readily expect reasonably similar results.

Mitsui is silent on the issue of tensile stress or flatness degree. The examiner is of the position that a system having the same components of the taught invention would have a tensile stress of less than -2μm. Specifically, a system similar to examples 3, 6 and 7, which contain helium gas in the amount of 20, 40 and 30 % respectively, would readily possess a tensile stress less than -2μm. Furthermore, it would have been obvious to one of ordinary skill in the art to determine how the gas mixture would affect the formed film.

Allowable Subject Matter

15. Claims 35-40, 43-46, 58-59 and 61-62 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

16. The following is a statement of reasons for the indication of allowable subject matter: review of the prior art failed to teach and/or suggest a photomask blank having (1) a thin film which is a laminated film comprising a shading layer and an antireflective layer as set forth in instant claims 35-36 and 58-59; (2) a thin film having a crystal grain size of 1 to 7 nm as in instant claim 43; and (3) a thin film having a nitride film formed between the transparent substrate and the thin film as in claims 44-45

Conclusion

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yvette C. Thornton whose telephone number is 703-305-0589. The examiner can normally be reached on Monday-Thursday 8-6:30.

18. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Janet C. Baxter can be reached on 703-308-2303. The fax phone numbers for the

organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

19. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-1495.

20. **Please note that the examiner has recently changed her name from "Clarke" to "Thornton".**

Yvette C. Thornton

Yvette Clarke Thornton
Junior Examiner
Art Unit 1752

yct
March 11, 2003